J O I N T C E N T E R
AEI-BROOKINGS JOINT CENTER FOR REGULATORY STUDIES

Precautions Against What?
The Availability Heuristic and Cross-Cultural Risk Perceptions

Cass R. Sunstein [*]

Working Paper 04-22
October 2004

[*] Cass R. Sunstein is the Karl N. Llewellyn Distinguished Service Professor, Law School and Department of Political Science, University of Chicago. He is grateful to Robert Hahn for valuable comments on a previous draft. The views expressed in this paper reflect those of the authors and do not necessarily reflect those of the institutions with which they are affiliated.

J O I N T C E N T E R

AEI-BROOKINGS JOINT CENTER FOR REGULATORY STUDIES

In order to promote public understanding of the impact of regulations on consumers, business, and government, the American Enterprise Institute and the Brookings Institution established the AEI-Brookings Joint Center for Regulatory Studies. The Joint Center's primary purpose is to hold lawmakers and regulators more accountable by providing thoughtful, objective analysis of relevant laws and regulations. Over the past three decades, AEI and Brookings have generated an impressive body of research on regulation. The Joint Center builds on this solid foundation, evaluating the economic impact of laws and regulations and offering constructive suggestions for reforms to enhance productivity and welfare. The views expressed in Joint Center publications are those of the authors and do not necessarily reflect the views of the Joint Center.

All AEI-Brookings Joint Center publications can be found at www.aei-brookings.org

Executive Summary

Because risks are all on sides of social situations, it is not possible to be globally "precautionary." Hence the Precautionary Principle, in its strongest forms, runs into fatal conceptual difficulties; any precautions will themselves create hazards of one or another kind. When the Precautionary Principle seems to give guidance, it is often because of the availability heuristic, which can make some risks stand out as particularly salient, whatever their actual magnitude. The same heuristic helps to explain differences across groups, cultures, and even nations in the perception of risks, especially when linked with such social processes as cascades and group polarization. An important complication here is that what is available is sometimes a result of predispositions, cultural and otherwise. There are complex links among availability, social processes for the spreading of information, and predispositions.

Precautions Against What?
The Availability Heuristic and Cross-Cultural Risk Perceptions

Cass R. Sunstein

> "Many Germans believe that drinking water after eating cherries is deadly; they also believe that putting ice in soft drinks is unhealthy. The English, however, rather enjoy a cold drink of water after some cherries; and Americans love icy refreshments."[1]

> "The most important factor contributing to the increased stringency of health, safety and environmental regulation in Europe has been a series of regulatory failures and crises that placed new regulatory issues on the political agenda and pressured policy makers to adopt more risk averse or precautionary policies. . . . The regulatory failure associated with BSE significantly affected the attitude of the European public toward GM foods. . . . Consumer and environmental regulations are likely to become more innovative, comprehensive and risk averse as a response to a widespread public perception of regulatory failures."[2]

1. Introduction

It has become standard to say that with respect to risks, Europe and the United States can be distinguished along a single axis: Europe accepts the Precautionary Principle, and the United States does not.[3] On this view, Europeans attempt to build a "margin of safety" into public decisions, taking care to protect citizens against risks that cannot be established with certainty. By contrast, Americans are reluctant to take precautions, requiring clear evidence of harm in

[1] See Joseph Henrich et al., Group Report: What is the Role of Culture in Bounded Rationality?, in Bounded Rationality: The Adaptive Toolbox 353-54, Gerd Gigerenzer & Reinhard Selten, eds. (Cambridge, Mass.: MIT Press, 2001), for an entertaining outline in connection with food choice decisions.

[2] David Vogel, The Hare and the Tortoise Revisited: The New Politics of Consumer and Environmental regulation in Europe, 33 B. J. Pol. S. 557, 568-69, 580 (2003).

[3] On some of the complexities here, see John S. Applegate, The Precautionary Preference: An American Perspective on the Precautionary Principle, 6 Hum. & Ecol. Risk Assess. 413 (2000); Peter H. Sand, The Precautionary Principle: A European Perspective, 6 Hum. & Ecol. Risk Assess. 445 (2000).

order to justify regulation. These claims seem plausible in light of the fact that the United States appears comparatively unconcerned about the risks associated with global warming and genetic modification of food; in those contexts, Europeans favor precautions, whereas Americans seem to require something more like proof of danger. To be sure, the matter is quite different in the context of threats to national security. For the war in Iraq, the United States (and England) followed a kind of Precautionary Principle, whereas other nations (most notably France and Germany) wanted clearer proof of danger. But for most threats to safety and health, many people believe that Europe is precautionary and the United States is not.

As a matter of fact, this opposition between Europe and America is false, even illusory.[4] It is simply wrong to say that Europeans are more precautionary than Americans. Empirically speaking, neither is "more precautionary." Europeans are not more averse to risks than Americans. They are more averse to particular risks,[5] such as the risks associated with global warming; but Americans have their own preoccupations as well. My larger point, a central claim of this essay, is conceptual. No nation can, even in principle, commit itself to precaution as such.[6] The real problem with the Precautionary Principle, at least in its strongest forms, is that it is incoherent; it purports to give guidance, but it fails to do so, because it condemns the very steps that it requires. Was the war in Iraq precautionary? Is it precautionary to ban cellular telephones, nuclear power plants, genetically modified food, and airplanes? These questions should be enough to suggest that precautions always give rise to risks of their own – and that the operation of the Precautionary Principle is inextricably intertwined with social risk perceptions.

Nations can regard themselves as "precautionary" only if they blind ourselves to many aspects of risk-related situations and focus on a narrow subset of what is at stake. That kind of self-blinding is what makes the Precautionary Principle seem to give guidance; and I shall have a fair bit to say about why people and societies are selective in their fears. My major hypothesis is that the availability heuristic is often the source of people's fears about certain risks.[7] If a

---

[4] See the illuminating discussions in Jonathan B. Wiener, Precaution, Risk, and Multiplicity (unpublished manuscript 2004); Jonathan B. Wiener & Michael D. Rogers, Comparing Precaution in the United States and Europe, 5 J Risk Research 317 (2002).

[5] See Vogel, supra note, for many examples in the context of health, safety, and the environment.

[6] I draw here from Cass R. Sunstein, Laws of Fear: Beyond the Precautionary Principle (Cambridge University Press, forthcoming 2005) and Cass R. Sunstein, Beyond the Precautionary Principle, 151 U. Pa. L. Rev. 1003 (2003).

[7] Undoubtedly a great deal can be learned from use of the psychometric paradigm, stressed in Bernd Rorhmann and Ortwin Renn, Risk Perception Research: An Introduction, in Cross-Cultural Risk Perception: A Survey of Empirical Studies 11, 17-18 (Ortwin Renn and Bernd Rorhmann eds. 2000). I stress the availability heuristic here because of

particular incident is cognitively "available" – both vivid and salient – then people will have a heightened fear of the risk in question. If people in one nation fear the risks associated with terrorism, and people in another nation fear the risks associated with mad cow disease, the availability heuristic is likely to be the reason. Hence cultural differences, with respect to application of the precautionary principle, are often rooted in availability. But this point misses some complexities, about both social influences and cultural predispositions; I shall turn to these in due course. The availability heuristic does not operate in a social or cultural vacuum.

In short, I aim here both to show that the Precautionary Principle is not quite what it seems and that its operation is underwritten by an identifiable heuristic with social and cultural foundations. The result is a hypothesis, to the effect that cross-cultural differences in both risk perception and in precautions are produced, in large part, by availability. I shall not be able to prove that hypothesis in this space, but I hope to be able to say enough to prove that the hypothesis is plausible, illuminating, and worth further exploration.

2. Weak and Strong

Begin with the Precautionary Principle.[8] There are twenty or more definitions, and they are not compatible with one another.[9] We can imagine a continuum of understandings. At one extreme are weak versions to which no reasonable person could object. At the other extreme are strong versions that would require a fundamental rethinking of regulatory policy.

The most cautious and weak versions suggest, quite sensibly, that a lack of decisive evidence of harm should not be a ground for refusing to regulate. Controls might be justified even if we cannot establish a definite connection between, for example, low-level exposures to certain carcinogens and adverse effects on human health. Thus the 1992 Rio Declaration states, "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."[10] The Ministerial Declaration of the Second International Conference on the

---

its comparative simplicity, but the heuristic interacts in complex ways with psychometrics and with culture; I try at least to scratch some of the surfaces here.

[8] This and the following sections draw from Sunstein, Beyond the Precautionary Principle, supra note.

[9] See Julian Morris, Defining the Precautionary Principle, in Rethinking Risk and the Precautionary Principle, supra note 13, at 1-19; Wiener, supra note.

[10] Quoted in Bjorn Lomborg, The Skeptical Environmentalist 347 (New York: Cambridge University Press, 2001).

Protection of the North Sea, held in London in 1987, is in the same vein: "Accepting that in order to protect the North Sea from possibly damaging effects of the most dangerous substances, a Precautionary Principle is necessary which may require action to control inputs of such substances even before a causal link has been established by absolutely clear scientific evidence."[11] Similarly, the United Nations Framework Convention on Climate Change offers cautious language: "Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing [regulatory] measures, taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost."[12]

The widely publicized Wingspread Declaration, from a meeting of environmentalists in 1998, goes somewhat further: "When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not established scientifically. In this context the proponent of the activity, rather than the public, should bear the burden of proof."[13] The first sentence just quoted is more aggressive than the Rio Declaration because it is not limited to threats of serious or irreversible damage. And in reversing the burden of proof, the second sentence goes further still. Of course everything depends on what those with the burden of proof must show in particular.

In Europe, the Precautionary Principle is sometimes understood in a still stronger way, suggesting that it is important to build "a margin of safety into all decision making."[14] According to one definition, the Precautionary Principle means "that action should be taken to correct a problem as soon as there is evidence that harm may occur, not after the harm has already occurred."[15] The word "may" is the crucial one here. In a comparably strong version, it is said that "the Precautionary Principle mandates that when there is a risk of significant health or environmental damage to others or to future generations, and when there is scientific uncertainty as to the nature of that damage or the likelihood of the risk, then decisions should be made so as to prevent such activities from being conducted unless and until scientific evidence shows that

---

[11] Quoted in Rethinking Risk and the Precautionary Principle 3, Julian Morris, ed. (Oxford: Butterworth-Heinemann, 2000).
[12] See Indur Goklany, The Precautionary Principle 6 (2001).
[13] Id. A strong version is defended in Carolyn Raffensperger & Peter L. deFur, Implementing the Precautionary Principle: Rigorous Science and Solid Ethics, 5 Hum. & Ecol. Risk Assess. 933, 934 (1999).
[14] See Bjorn Lomborg, The Skeptical Environmentalist 348 (New York: Cambridge University Press, 2001).
[15] *http://www.logophilia.com/WordSpy/precautionaryprinciple.asp*

the damage will not occur."[16] The words "will not occur" seem to require proponents of an activity to demonstrate that there is no risk at all – often an impossible burden to meet. The Cartagena Protocol on Biosafety to the Convention on Biological Diversity, adopted in 2000, appears to adopt a strong version as well.[17] The Final Declaration of the First European "Seas At Risk" conference says that if "the 'worst case scenario' for a certain activity is serious enough then even a small amount of doubt as to the safety of that activity is sufficient to stop it taking place."[18]

3. Safe and Sorry?

The weak versions of the Precautionary Principle are unobjectionable and important. Every day, individuals and nations take steps to avoid hazards that are far from certain. We do not walk in moderately dangerous areas at night; we exercise; we buy smoke detectors; we buckle our seatbelts; we might even avoid fatty foods (or carbohydrates). Sensible governments regulate risks that, in individual cases or even in the aggregate, have much less than a 50% chance of coming to fruition. An individual might ignore a mortality risk of 1/500,000, because that risk is quite small, but if 100 million citizens face that risk, the nation had better take it seriously. With respect to the weak version of the Precautionary Principle, there are significant cross-cultural variations; but no serious person rejects that weak version.

It is also possible to identify versions that are not so much weak as narrow. When citizens face catastrophic risks to which probabilities cannot be assigned, it makes sense for them to adopt what might be called an *Anti-Catastrophe Principle*. If regulators are able to assign probabilities to extremely serious risks, they might well do best to follow maximin, identifying the worst-case scenarios and choosing the approach that eliminates the worst of these[19] -- so long as the effort at elimination does not itself create catastrophic risks or otherwise impose extremely serious costs. In addition, the Precautionary Principle is plausibly invoked in cases involving

[16] Testimony of Dr. Brent Blackwelder, President, Friends of the Earth, before the Senate Appropriations Committee, Subcommittee on Labor, Health and Human Services, (Jan. 24, 2002).
[17] See Goklany, supra note, at 6.
[18] Final Declaration of the First European "Seas At Risk" Conference, Annex 1, Copenhagen, 1994.
[19] See Cass R. Sunstein, Laws of Fear: Beyond the Precautionary Principle (forthcoming 2005); see also Richard A. Posner, Catastrophe: Risk and Response (Cambridge: Harvard University Press, 2004).

risks of irreversible harm.[20] If an irreversible harm is one side, and a reversible one on the other, it might be worthwhile to spend a certain amount to preserve future flexibility by paying a premium to avoid the irreversible harm.[21] In any case, margins of safety are hardly limited to catastrophic or irreversible risks; they are reasonable in many contexts. A narrow version of the Precautionary Principle might urge that for risks that justify the most serious concern, margins of safety, embodying a form of risk aversion, are sensible.

For the moment, however, let us understand the principle in a way that is both strong and wide, to suggest that regulation is required whenever there is a possible risk to health, safety, or the environment, even if the supporting evidence remains speculative and even if the economic costs of regulation are high. This understanding of the Precautionary Principle captures the view of many of those who support it. To avoid absurdity, the idea of "possible risk" must be understood to require a certain threshold of scientific plausibility. To support regulation, no one thinks that it is enough if someone, somewhere, urges that a risk is worth taking seriously. But under the Precautionary Principle as I shall understand it, the threshold burden is minimal, and once it is met, there is something like a presumption in favor of regulatory controls. This version, as we shall see, helps to clarify a significant problem with the idea of precaution, and also to illuminate the existence of cross-national differences.

4. Why Precautionary Principle Is Paralyzing

Why might the Precautionary Principle, understood in its strong sense, have such widespread appeal? At first glance, the answer is simple, for the principle contains some important truth. Certainly we should acknowledge that a small probability (say, 1 in 25,000) of a serious harm (say, 1,000,000 deaths) deserves extremely serious attention. It is worthwhile to spend a lot of money to eliminate that risk. An economically oriented critic might observe that our resources are limited and that if we spend large amounts of resources on highly speculative harms, we will not be allocating those resources wisely. In fact this is the simplest criticism of

[20] For a valuable and somewhat technical discussion see Christian Gollier and Nicolas Treich, Decision-Making under Scientific Uncertainty: The Economics of the Precautionary Principle, 27 J Risk and Uncertainty 77 (2003).
[21] See Kenneth Arrow and Anthony Fischer, Environmental Preservation, Uncertainty and Irreversibility, 88 Q. J. Economics 312, 313-14 (1974).

the Precautionary Principle.[22] If we take costly steps to address all risks, however improbable they are, we will quickly impoverish ourselves. On this view, the Precautionary Principle "would make for a dim future."[23] It would also eliminate technologies and strategies that make human lives easier, more convenient, healthier, and longer. In the context of global warming, aggressive regulation might impose high costs on many people who are now poor for the benefit of people, yet to be born, who will be richer, if only because wealth tends to grow over time, and shows every sign of continuing to do so.

But there is something both odd and revealing about these claims. The Precautionary Principle is designed to decrease morbidity and mortality; how could it possibly make the future "dim"? I suggest that the real problem with the principle, taken in its standard forms,[24] is that it offers no guidance – not that it is wrong, but that it forbids all courses of action, including regulation. Taken seriously, it bans the very steps that it requires. To understand the difficulty, it will be useful to anchor the discussion in some concrete problems:

1. Genetic modification of food has become a widespread practice.[25] The risks of that practice are not known with any precision. Some people fear that genetic modification will result in serious ecological harm and large risks to human health; others believe that genetic modification will result in more nutritious food and significant improvements in human health.
2. Scientists are not in accord about the dangers associated with global warming,[26] but there is general agreement that global warming is in fact occurring. It is possible that global warming will produce, by 2100, a mean temperature increase of 4.5 degrees C (the high-end estimate of the International Panel on Climate Change); that it will result in $5 trillion or more in monetized costs; and that it will also produce a significant number of

[22] See John D. Graham, Decision-Analytic Refinements of the Precautionary Prnciple, 4 J. Risk Research 127 (2001).
[23] See Julian Morris, Defining the Precautionary Principle, in Rethinking Risk and the Precautionary Principle, supra note, at 1, 17.
[24] I explore nonstandard forms in Cass R. Sunstein, Laws of Fear: Beyond the Precautionary Principle (Cambridge: Cambridge University Press, forthcoming 2005).
[25] Alan McHughen, Pandora's Picnic Basket (New York: Oxford University Press, 2000).
[26] For discussion, see Richard A. Posner, Catastrophe: Risk and Response (New York: Oxford University Press, 2004); Bjorn Lomborg, The Skeptical Environmentalist (New York: Cambridge University Press, 2001); William D. Nordhaus & Joseph Boyer, Warming the World: Economic Models of Global Warming 168 (Cambridge, Mass.: MIT Press, 2000).

deaths from malaria. The Kyoto Protocol would require most industrialized nations to reduce greenhouse gas emissions to 92%-94% of 1990 levels. A great deal of work suggests that significant decreases in such emissions would have large benefits; but skeptics contend that the costs of such decreases would reduce the well-being of millions of people, especially the poorest members of society.

3. Many people fear nuclear power, on the ground that nuclear power plants create various health and safety risks, including some possibility of catastrophe. But if a nation does not rely on nuclear power, it might well rely instead on fossil fuels, and in particular on coal-fired power plants. Such plants create risks of their own, including risks associated with global warming. China, for example, has relied on nuclear energy, in a way that reduces greenhouse gases and a range of air pollution problems.[27]
4. In the first years of the twenty-first century, one of the most controversial environmental issues in the United States involved the regulation of arsenic in drinking water. There is a serious dispute over the precise level of risks posed by low levels of arsenic in water, but on the "worst case" scenario, over one hundred lives might be lost each year as a result of the 50 part-per-billion standard that the Clinton Administration sought to revise. At the same time, the proposed 10 part-per-billion standard would cost over $200 million each year, and it is possible that it would save as few as six lives annually.

In these cases, what kind of guidance is provided by the Precautionary Principle? It is tempting to say, as is in fact standard, that the principle calls for strong controls on genetic engineering of food, on greenhouse gases, on arsenic, and on nuclear power. In all of these cases, there is a possibility of serious harms, and no authoritative scientific evidence demonstrates that the possibility is close to zero. If the burden of proof is on the proponent of the activity or processes in question, the Precautionary Principle would seem to impose a burden of proof that cannot be met. Put to one side the question whether the Precautionary Principle, understood to

[27] See Ling Zhong, Note: Nuclear Energy: China's Approach Towards Addressing Global Warming, 12 Geo. Int'l Envtl. L. Rev. 493 (2000). Of course it is possible to urge that nations should reduce reliance on either coal-fired power plants or nuclear power, and move instead toward environmentally preferred alternatives, such as solar power. For general discussion, see Renewable Energy: Power for a Sustainable Future, Godfrey Boyle, ed. (Oxford: Oxford University Press in association with the Open University, 1996); Allan Collinson, Renewable Energy (Austin, Tex.: Steck-Vaughn Library, 1991); Dan E. Arvizu, Advanced Energy Technology and Climate Change Policy Implications, 2 Fl. Coastal L.J. 435 (2001). But these alternatives pose problems of their own, involving feasibility and expense. See Lomborg, supra note, at 118-48.

compel stringent regulation in these cases, is sensible. Let us ask a more fundamental question: Is that more stringent regulation therefore compelled by the Precautionary Principle?

The answer is that it is not. In some of these cases, it should be easy to see that in its own way, stringent regulation would actually run afoul of the Precautionary Principle. The simplest reason is that such regulation might well deprive society of significant benefits, and hence produce serious harms that would otherwise not occur. In some cases, regulation eliminates the "opportunity benefits" of a process or activity, and thus causes preventable deaths. If this is so, regulation is hardly precautionary. Consider the "drug lag," produced whenever the government takes a highly precautionary approach to the introduction of new medicines and drugs onto the market. If a government insists on such an approach, it will protect people against harms from inadequately tested drugs; but it will also prevent people from receiving potential benefits from those very drugs. Is it "precautionary" to require extensive premarketing testing, or to do the opposite?

In the context of medicines to prevent AIDS, those who favor "precautions" have asked governments to reduce the level of premarketing testing, precisely in the interest of health. The United States, by the way, is more precautionary about new medicines than are most European nations. But by failing to allow such medicines on the market, the United States fails to take precautions against the illnesses that could be reduced by speedier procedures.

Or consider the continuing debate over whether certain antidepressants impose a (small) risk of breast cancer.[28] A precautionary approach might seem to caution against use of such antidepressants because of their carcinogenic potential. But the failure to use those depressants might well impose risks of its own, certainly psychological and possibly even physical (because psychological ailments are sometimes associated with physical ones as well). Or consider the decision, by the Soviet Union, to evacuate and relocate more than 270,000 people in response to the risk of adverse effects from the Chernobyl fallout. It is not clear that on balance, this massive relocation project was justified on health grounds: "A comparison ought to have been made between the psychological and medical burdens of this measure (anxiety, psychosomatic

[28] See Judith P. Kelly et al., Risk of Breast Cancer According to Use of Antidepressants, Phenothiazines, and Antihistamines, 150 Am. J. Epidemiology 861 (1999); C.R. Sharpe et al., The Effects of Tricyclic Antidepressants on Breast Cancer Risk, 86 Brit. J. of Cancer 92 (2002).

diseases, depression and suicides) and the harm that may have been prevented."[29] More generally, a sensible government might want to ignore the small risks associated with low levels of radiation, on the ground that precautionary responses are likely to cause fear that outweighs any health benefits from those responses.[30]

Or consider a more general question about how to handle low-level toxic agents, including carcinogens. Do such agents cause adverse effects? If we lack clear evidence, it might seem "precautionary" to assume that they do, and hence to assume, in the face of uncertainty, that the dose-response curve is linear and without safe thresholds.[31] In the United States, this is the default assumption of the Environmental Protection Agency. But is this approach unambiguously precautionary? Considerable evidence suggests that many toxic agents that are harmful at high levels are actually beneficial at low levels.[32] Thus "hormesis" is a dose-response relationship in which low doses stimulate desirable effects and high doses inhibit them. When hormesis is involved, government use of a linear dose-response curve, assuming no safe thresholds, will actually cause mortality and morbidity effects. Which default approach to the dose-response curve is precautionary? To raise this question is not to take any stand on whether some, many, or all toxic agents are beneficial or instead harmful at very low doses. It is only to say that the simultaneous possibility of benefits at low levels and of harms at low levels makes the Precautionary Principle paralyzing. The principle requires use of a linear, non-threshold model; but it simultaneously condemns use of that very model. For this and other reasons, unreflective use of the Precautionary Principle, it has been argued, threatens to increase rather than decrease the risks associated with food.[33]

Or consider the case of genetic modification of food. Many people believe that a failure to allow genetic modification might well result in numerous deaths, and a small probability of many more. The reason is that genetic modification holds out the promise of producing food that

---

[29] Maurice Tubiana, Radiation Risks in Perpective: Radiation-Induced Cancer Among Cancer Risks, 39(1) Radiat. Environ. Biophy. 3, 8-10 (2000).

[30] Id. For some counterevidence in an important context, see Lennart Hardell et al., Further Aspects on Cellular and Cordless Telephones and Brain Tumours, 22 Intl. J. Oncology 399 (2003) (discussing evidence of an association between cellular telephones and cancer).

[31] For criticism of the linearity assumption, see Maurice Tubiana, Radiation Risks in Perpective: Radiation-Induced Cancer Among Cancer Risks, 39(1) Radiat. Environ. Biophy. 3, 8-9 (2000).

[32] See Edward J. Calabrese and Linda A. Baldwin, Hormesis: The Dose Response Revolution, 43 Annu. Rev. Pharmacol. Toxicol. 175 (2003); Edward J. Calabrese and Linda A. Baldwin, The Hormetic Dose-Response Model is More Common Than the Threshold Model in Toxicology, 71 Toxcol. Sciences 246 (2003).

is both cheaper and healthier – resulting, for example, in "golden rice," which might have large benefits in developing countries. My point is not that genetic modification will likely have those benefits, or that the benefits of genetic modification outweigh the risks. The claim is only that if the Precautionary Principle is taken literally, it is offended by regulation as well as by nonregulation.

The example suggests that regulation sometimes violates the Precautionary Principle because it gives rise to substitute risks, in the form of hazards that materialize, or are increased, as a result of regulation.[34] Consider the case of DDT, often banned or regulated in the interest of reducing risks to birds and human beings. The problem with such bans is that in poor nations, they eliminate what appears to be the most effective way of combating malaria – and thus significantly undermine public health.[35] Or consider the United States Environmental Protection Agency's effort to ban asbestos,[36] a ban that might well seem justified or even compelled by the Precautionary Principle. The difficulty, from the standpoint of that very principle, is that substitutes for asbestos also carry risks. The problem is pervasive. In the case of arsenic, the Administrator of the Environmental Protection Agency expressed concern that aggressive regulation, by virtue of its cost, will lead people to cease using local water systems and to rely on private wells, which have high levels of contamination.[37] If this is so, stringent arsenic regulation violates the Precautionary Principle no less than less stringent regulation does. This is a common situation, for opportunity benefits and substitute risks are the rule, not the exception.[38]

---

[33] J.C. Hanekamp et al., Chloramphenicol, Food Safety, and Precautionary Thinking in Europe, 6 Env. Liability 209 (2003).

[34] See the discussion of risk-related tradeoffs in John Graham & Jonathan Wiener, Risk vs. Risk (Cambridge, Mass.: Harvard University Press, 1995); Cass R. Sunstein, Health-Health Tradeoffs, in Cass R. Sunstein, Risk and Reason, 133-52 (Cambridge: Cambridge University Press, 2002).

[35] See Goklany, supra note, at 13-27.

[36] See *Corrosion Proof Fittings v. EPA*, 947 F.2d 1201 (5th Cir., 1991).

[37] "But we have seen instances, particularly in the West and Midwest, where arsenic is naturally occurring at up to 700 and more parts per billion, where the cost of remediation has forced water companies to close, leaving people with no way to get their water, save dig wells. And then they are getting water that's even worse than what they were getting through the water company." Christine Todd Whitman, Administrator, U.S. Environmental Protection Agency, in interview by Robert Novak & Al Hunt, *CNN Evans, Novak, Hunt & Shields*, Cable News Network, (April 21, 2001).

[38] Note also that some regulation will have ancillary benefits, by reducing risks other than those that are specifically targeted. For a valuable discussion, see Samuel J. Rascoff & Richard L. Revesz, The Biases of Risk Tradeoff Analysis, 69 U. Chi. L. Rev. 1763 (2002).

It is possible to go much further. A great deal of evidence suggests the possibility that an expensive regulation can have adverse effects on life and health. [39] It has been urged that a statistical life can be lost for every expenditure of $7 million[40]; one study suggests that an expenditure of $15 million produces a loss of life.[41] Another suggests that poor people are especially vulnerable to this effect – that a regulation that reduces wealth for the poorest 20% of the population will have twice as large a mortality effect as a regulation that reduces wealth for the wealthiest 20%.[42] To be sure, both the phenomenon and the underlying mechanisms are disputed.[43] I do not mean to accept any particular amount here, or even to suggest that there has been an unambiguous demonstration of an association between mortality and regulatory expenditures. The only point is that reasonable people believe in that association. It follow that a multimillion dollar expenditure for "precaution" has -- as a worst case scenario -- significant adverse health effects, with an expenditure of $200 million as leading to perhaps as many as twenty to thirty lives lost.

This point makes the Precautionary Principle hard to implement not merely where regulation removes "opportunity benefits," or introduces or increases substitute risks, but in any case in which the regulation costs a significant amount. If this is so, the Precautionary Principle, for that very reason, raises doubts about many regulations. If the principle argues against any action that carries a small risk of imposing significant harm, then we should be reluctant to spend a lot of money to reduce risks, simply because those expenditures themselves carry risks. Here is the sense in which, the Precautionary Principle, taken for all that it is worth, is paralyzing: It stands as an obstacle to regulation and nonregulation, and to everything in between.

It should now be easier to understand my earlier suggestion that despite its formal enthusiasm for the Precautionary Principle, European nations are not "more precautionary" than the United States. Simply as a logical matter, societies, like individuals, cannot be highly

---

[39]Ralph Keeney, Mortality Risks Induced by Economic Expenditures, 10 Risk Anal. 147 (1990); Randall Lutter & John F. Morrall, III, Health-Health Analysis: A New Way to Evaluate Health and Safety Regulation, 8(1) J. Risk & Uncertainty 43, 49 table 1 (1994).

[40] See Keeney, supra note 72.

[41] See Robert W. Hahn et al., Do Federal Regulations Reduce Mortality? (Washington, D.C.: American Enterprise Institute, 2000).

[42] See Kenneth S. Chapman & Govind Hariharan, Do Poor People Have a Stronger Relationship Between Income and Mortality Than the Rich? Implications of Panel Data for Health-Health Analysis, 12 J. Risk & Uncertainty 51, 58-63 (1996).

[43]See Randall Lutter & John F. Morrall, III, Health-Health Analysis: A New Way to Evaluate Health and Safety Regulation, 8 J. Risk & Uncertainty 43, 49 table 1 (1994).

precautionary with respect to all risks. Each society and each person must select certain risks for special attention. In these respects, the selectivity of precautions is not merely an empirical fact; it is a conceptual inevitability. Comparing Europe to the United States, Jonathan Wiener and Michael Rogers have demonstrated this point empirically.[44] In the early twenty-first century, for example, the United States appears to take a highly precautionary approach to the risks associated with abandoned hazardous waste dumps and terrorism, but not to take a highly precautionary approach to the risks associated with global warming, indoor air pollution, poverty, poor diet, and obesity. It would be most valuable to attempt to see which nations are especially precautionary with respect to which risks, and also to explore changes over time. In addition, it would be important to distinguish between regulation on the books and regulation as it works in the real world; it is entirely possible, for example, that the United States and Europe differ more on paper than in reality.

A nation-by-nation study commissioned by the German Federal Environmental Agency goes so far as to conclude that there are two separate camps in the industrialized world: "precaution countries" (Germany, Sweden, the Netherlands, and the United States) and "protection countries" (Japan, France, and the United Kingdom).[45] But this conclusion seems to me ludicrously implausible. The universe of risks is far too large to permit categorizations of this kind. The most general point is that no nation is precautionary in general and costly precautions are inevitably taken against only those hazards that seem especially salient or insistent.[46] The problem with the Precautionary Principle is that it wrongly suggests that nations can and should adopt a general form of risk aversion.

5. The Availability Heuristic

I suggest that in its standard form, the Precautionary Principle becomes operational if and only if those who apply it wear blinders – only, that is, if they focus on some aspects of the regulatory situation but downplay or disregard others.[47] But this suggestion simply raises an additional question: What accounts for the particular blinders that underlie applications of the

[44] See Wiener and Rogers, supra note.
[45] See Sand, supra note, at 448.
[46] See Vogel, supra note, at 570-71, for a demonstration of this point for Europe.

Precautionary Principle? What people's attention is selective, why is it selective in the way that it is? What might different nations, with quite different policies, all believe that they are being precautionary? Much of the answer, I contend, lies in an understanding of behavioral economics and cognitive psychology, which provide important clues to cross-cultural differences in risk perception. The availability heuristic is the place to start.

It is well-established that in thinking about risks, people rely on certain heuristics, or rules of thumb, which serve to simplify their inquiry.[48] Heuristics typically work through a process of "attribute substitution," in which people answer a hard question by substituting an easier one.[49] Should we be fearful of nuclear power, terrorism, abduction of young children, mad cow disease, contaminated blood, or pesticides? When people use the availability heuristic, they assess the magnitude of risks by asking whether examples can readily come to mind.[50] If people can easily think of such examples, they are far more likely to be frightened than if they cannot. The availability heuristic illuminates the operation of the Precautionary Principle, by showing why some hazards will be on-screen and why others will be neglected. The availability heuristic also tells us a great deal about differences in risk perceptions across groups, cultures, and even nations.

For example, "a class whose instances are easily retrieved will appear more numerous than a class of equal frequency whose instances are less retrievable."[51] Consider a simple study showing people a list of well-known people of both sexes, and asking them whether the list contains more names of women or more names of men. In lists in which the men were especially famous, people thought that they were more names of men, whereas in lists in which the women were the more famous, people thought that there were more names of women.[52]

This is a point about how familiarity can affect the availability of instances. A risk that is familiar, like that associated with terrorism, will be seen as more serious than a risk that is less familiar, like that associated with sun-bathing. But salience is important as well. "For example,

---

[47] A narrower version of the Precautionary Principle, which I call the Anti-Catastrophe Principle, is defended in Cass R. Sunstein, Laws of Fear (Cambridge: Cambridge University Press, forthcoming 2005).
[48] See Daniel Kahneman, Paul Slovic, & Amos Tversky, Judgment Under Uncertainty: Heuristics and Biases (Cambridge; New York: Cambridge Univ. Press, 1982).
[49] See Daniel Kahneman & Shane Frederick, Representativeness Revisited: Attribute Substitution in Intuitive Judgment 49, 53 in Heuristics and Biases: The Psychology of Intuitive Judgment, Thomas Gilovich, Dale Griffin, & Daniel Kahneman, eds. (Cambridge: Cambridge Univ. Press, 2002).
[50] See Amos Tversky & Daniel Kahneman, Judgment Under Uncertainty: Heuristics and Biases, in id. at 3, 11-14.
[51] Id. at 11.
[52] Id.

the impact of seeing a house burning on the subjective probability of such accidents is probably greater than the impact of reading about a fire in the local paper."[53] So too, recent events will have a greater impact than earlier ones. The point helps explain differences across time and space in much risk-related behavior, including decisions to take precautions. Whether people will buy insurance for natural disasters is greatly affected by recent experiences.[54] If floods have not occurred in the immediate past, people who live on flood plains are far less likely to purchase insurance. In the aftermath of an earthquake, insurance for earthquakes rises sharply – but it declines steadily from that point, as vivid memories recede. Note that the use of the availability heuristic, in these contexts, is hardly irrational.[55] Both insurance and precautionary measures can be expensive, and what has happened before seems, much of the time, to be the best available guide to what will happen again. The problem is that the availability heuristic can lead to serious errors, in terms of both excessive fear and neglect.

What, in particular, produces availability? An intriguing essay attempts to test the effects of ease of imagery on perceived judgments of risk.[56] The study asked subjects to read about an illness (Hyposcenia-B) that "was becoming increasingly prevalent" on the local campus. In one condition, the symptoms were concrete and easy to imagine -- involving muscle aches, low energy, and frequent severe headaches. In another condition, the symptoms were vague and hard to imagine, involving an inflamed liver, a malfunctioning nervous system, and a general sense of disorientation. Subjects in both conditions were asked to imagine a three-week period in which they had the disease and to write a detailed description of what they imagined. After doing so, subjects were asked to assess, on a ten-point scale, their likelihood of contracting the disease. The basic finding was that likelihood judgments were very different in the two conditions, with

---

[53] Id.

[54] Paul Slovic, The Perception of Risk 40 (London; Sterling, Va.: Earthscan Publications, 2000).

[55] Kahneman and Tversky emphasize that the heuristics they identify "are highly economical and usually effective," but also that they "lead to systematic and predictable errors." See Amos Tversky & Daniel Kahneman, Judgment Under Uncertainty: Heuristics and Biases, in Judgment and Decision Making: An Interdisciplinary Reader 38, 55, Hal R. Arkes & Kenneth R. Hammond, eds. (Cambridge; New York: Cambridge Univ. Press, 1986). Gerd Gigenzer, among others, has emphasized that some heuristics can work extremely well, see Gerd Gigerenzer et al., Simple Heuristics That Make Us Smart (New York: Oxford Univ. Press, 1999); Gerd Gigerenzer, Adaptive Thinking: Rationality in the Real World (New York: Oxford Univ. Press, 2000), and used this point as a rejoinder to those who stress the errors introduced by heuristics and biases. I do not mean to take a stand on the resulting debates. Even if many heuristics mostly work well in daily life, a sensible government can do much better than to rely on them.

[56] In Steven J. Sherman et al., Imagining Can Heighten or Lower the Perceived Likelihood of Contracting a Disease: The Mediating Effect of Ease of Imagery, in Heuristics and Biases: The Psychology of Intuitive Judgment 82, Thomas Gilovich et al., eds. (Cambridge; New York: Cambridge Univ. Press, 2002).

easily-imagined symptoms making people far more inclined to believe that they were likely to get the disease.

The availability heuristic helps to explain the operation of the Precautionary Principle and cross-national differences for a simple reason: Sometimes a certain risk, said to call for precautions, is cognitively available, whereas other risks, including those associated with regulation itself, are not. In many cases where the Precautionary Principle seems to offer guidance, the reason is that some of the relevant risks are available while others are barely visible. And if one nation is concerned with the risk of sunbathing and another is not, availability is likely to provide a large part of the reason. This, then, is my central hypothesis: Differences across nations, in the perception of risks, have a great deal to do with the operation of the availability heuristic.

To be sure, those differences are also motivated in large part by actual differences in risk levels. Fortunately, reality matters. Nations suffering from high levels of malaria are likely to perceive malaria risks as far greater than nations in which malaria is not a problem. Countries that face serious risks from contaminated blood will probably show greater fear of contaminated blood than countries in which contaminated blood is not a problem. But availability produces differences in perceptions that do not track differences in reality.

The study of cross-cultural risk perceptions remains in its infancy,[57] and hence my claim must remain only a hypothesis, one that I cannot demonstrate to be true. What is necessary, and what is lacking, is anything like comprehensive information about cross-cultural risk perceptions, allowing us to test the role of availability. And we shall shortly see some complexities that bear on the adequacy of the availability hypothesis. But for now, consider some supportive evidence:

1. Within the United States, public concern about risks usually does track changes in the actual fluctuations in those risks. But public concern outruns actual fluctuations in the important case of "panics," bred by vivid illustrations that do not reflect changes in levels of danger.[58] At certain points in the 1970s and 1980s, there were extreme leaps in

[57] See Cross-Cultural Risk Perception: A Survey of Empirical Studies (Ortwin Renn and Bernd Rorhmann eds. 2000).
[58] See George Loewenstein and Jane Mather, Dynamic Processes in Risk Perception, 3 J. Risk and Uncertainty 155 (1990).

concern about teenage suicides, herpes, illegitimacy, and AIDS – leaps that did not correspond to changes in the size of the problem. Availability, produced by "a particularly vivid case or new finding that receives considerable media attention," played a major role in those leaps in public concern.[59] Sometimes the concern led to unjustified precautions, as in the behavior of some parents who refused to allow their children to attend classes having students with signs of herpes.

2. Availability helps to explain the findings of a cross-national study of perceptions of risk associated with terrorism and SARS.[60] In that study, Americans perceived terrorism to be a far greater threat, to themselves and to others, than SARS; Canadians perceived SARS to be a greater threat, to themselves and to others, than terrorism. Americans estimated their chance of serious harm from terrorism as 8.27%, about four times as high as their estimate of their chance of serious harm from SARS (2.18%). Canadians estimated their chance of serious harm from SARS as 7.43%, significantly higher than their estimate for terrorism (6.04%). Notably, the figures for SARS were unrealistically high, especially for Canadians; the best estimate of the risk of contracting SARS, based on Canadian figures, was .0008% (and the chance of dying as a result less than .0002%). For obvious reasons, the objective risks from terrorism are much harder to calculate, but if it is estimated that the United States will suffer at least one terrorist attack each year with the same number of deaths as on September 11, the risk of death from terrorism is about .001% -- a speculative number under the circumstances, but not an implausible place to start.

The availability heuristic helps to account for these cross-national differences and for the generally exaggerated risk perceptions. In the United States, risks of terrorism have (to say the least) received a great deal of attention, producing a continuing sense of threat. But there have been no incidents of SARS, and the media coverage has been limited to events elsewhere – producing a degree of salience, but far lower than that associated with terrorism. In Canada, the opposite is the case. The high degree of public discussion of SARS cases, accompanied by readily available instances, produced an inflated sense of the numbers – sufficiently inflated to

[59] Id. at 172.
[60] See Neal Feigenson et al., Perceptions of Terrorism and Disease Risks: A Cross-National Comparison, U. Cin. L. Rev. (forthcoming 2005).

exceed the same numbers from terrorism (certainly a salient risk in Canada, as in most nations post 9/11).

1. What accounts for people's perception of their risk of being infected with HIV? Why are some people and some groups largely unconcerned about that risk, while other people and groups are highly focused on with it? A study of rural Kenya and Malawi suggests that availability plays a critical role.[61] The authors find that risk perception is a product of discussions that "are often provoked by observing or hearing about an illness or death."[62] People "know in the abstract how HIV is transmitted and how it can be prevented," but they are unclear "about the advisability and effectiveness of the changes in sexual behavior that are recommended by experts.[63] Perceptions of the risk of HIV transition are very much a function of social networks, with pronounced changes in belief and behavior resulting from interactions with other people expressing a high level of concern. The effects of social networks are thus asymmetric, with substantial effects from having "at least one network partner who is perceived to have a great deal of concern about AIDS." The authors do not refer explicitly to the availability heuristic, but their findings are compatible with the suggestion that with respect to AIDS, risk perceptions are produced by availability.
2. A study of Bulgaria and Romania concludes that differences in levels of perceived risk "cannot be explained by differences in levels of real risk."[64] Indeed, the content of media are "a more potent determinant of perceived risk than real risk."[65] Cultural variables were not found to be crucial. In general, "perceived risk is a function of real risk and perhaps media risk rather than culturally contingent values and belief."[66]
3. There are many commonalities between the risk perceptions of Americans and those of citizens of France.[67] But such differences as there are have a great deal to do with

[61] See Jere R. Behrman et al., Social Networks, HIV/AIDS, and Risk Perceptions (Feb, 18, 2003), available at ssrn.com.
[62] Id. at 10.
[63] Id. at 18.
[64] See Lennart Sjoberg et al., Risk Perception in Bulgaria and Romania, in id. at 147.
[65] Id.
[66] Id. at 178.
[67] Paul Slovic et al., Nuclear Power and the Public: A Comparative Study of Risk Perception in France and the United States, in Cross-Cultural Risk Perception 55 (Ortwin Renn and Bernd Rohrmann eds. 2000).

availability. Hence there is far more concern in France with genetically engineered bacteria, a risk with a high degree of publicity.[68] By contrast, Americans show far more concern in the United States with coal-fired power plants, with radon in home, and with sun-tanning – three much-publicized sources of risk.[69]

4. What accounts for the recent rise of precautionary thinking in Europe? Why have certain environmental and health risk achieved so much salience in England, France, and the European Union generally? A comprehensive study suggests that a few readily available incidents played a large role.[70] In the 1990s, a "wave of crises" involving food safety, above all mad cow disease, led to the deaths of about one hundred people, with especially large effects on public attitudes.[71] In a tribute to the operation of availability, the "regulatory failure associated with BSE significantly affected the attitude of the European public toward GM foods."[72] An additional "scandal was the apparent failure of French government officials and doctors to protect haemopholiacs from blood contaminated with AIDS" virus, in a way that had large repercussions for public opinion in France.[73] The conclusion is that differences between European and American policies are not a product of deep-rooted cultural differences, but instead have a great deal to do with "widespread public perception of regulatory failures," often based on particular, vivid, and widely salient events.[74]

6. Social Influences

Thus far my emphasis has been on individual cognition. But to say the least, the availability heuristic does not operate in a social vacuum. What is readily "available" to some individuals, groups, cultures, and nations will not be available to all. Within the United States, many of those who favor gun control legislation have "available" a set of incidents in which such legislation would have avoided unnecessary deaths; many of those who reject such legislation are alert to incidents in which private gun ownership allowed people to fend off

[68] Id. at 74.
[69] Id.
[70] See Vogel, supra note.
[71] Id. at 568-69.
[72] ID. at 569.
[73] Id. at 570-71.

criminal violence.[75] Obviously both government and the media make some risks appear particularly salient. Consider President George W. Bush's plea: "Imagine those 19 hijackers [involved in the 9/11 attacks] with other weapons and plans, this time armed by Saddam Hussein. It would take one vial, one canister, one crate slipped into this country to bring a day of horror like none we have ever known." Environmentalists, in and out of government, operate in the same way, focusing public attention on potentially catastrophic harms. Well-organized private groups play a central role in activating public concern.

The question suggests the need to attend to the social and cultural dimensions of fear and risk perception. In many cases of high-visibility, low-probability dangers, such as sniper attacks, shark attacks, contaminated blood, and the kidnapping of young girls, the sources of availability are not obscure. The mass media focus on those risks; people communicate their fear and concern to one another; the widespread fact of fear and concern increases media attention; and the spiral continues until people move on. Hence the "risk of the month" syndrome, familiar in many societies, stems from the interaction between availability and social influences. Much of the time, however, what is available and salient to some is not available and salient to all. For example, many of those who endorse the Precautionary Principle focus on cases in which the government failed to regulate some environmental harm, demanding irrefutable proof, with the consequence being widespread illness and death. To such people, the available incidents require strong precautions in the face of uncertainty. But many other people, skeptical of the Precautionary Principle, focus on cases in which the government overreacted to weak science, causing large expenditures for little gain in terms of health or safety. To such people, the available incidents justify a measure of restraint in the face of uncertainty. Which cases will be available and to whom?

In any case people and cultures have different predispositions. These predispositions play a large role in determining which, of the numerous possibilities, is salient. If you are predisposed to be fearful of genetic modification of food, you are more likely to seek out, and to recall, incidents in which genetic modification was said to cause harm. If you are predisposed to fear electromagnetic fields, you will pay attention to apparent incidents in which electromagnetic fields have produced an elevated incidence of cancer. If you are predisposed to believe that most

---

[74] Id. at 580.

media scares are false or trumped-up, you will find cases in which public fears have been proved baseless. These are examples of individual predispositions, but undoubtedly cultural forces, some deep and some less so, help account for differences across nations.

Availability helps to determine beliefs, to be sure; but beliefs help to determine availability as well. Both beliefs and availability are endogenous to one another. When social and cultural forces interact with salience, to produce concern about one set of problems but not another, predispositions are crucial. It is in this sense that availability can be a product of forces that must be explained independently. But let us now turn to how availability spreads.

7. Cascades

Sometimes availability and salience are produced through social bandwagons or cascades, in which apparently representative anecdotes and gripping examples move rapidly from one person to another.[76] Consider a stylized example. Andrew hears of a dangerous event, which he finds to be revealing or illustrative. (The event might involve crime, terrorism, pesticides, environmental hazards, or threats to national security.) Andrew tells Barry, who would be inclined to see the event as not terribly informative, but who, learning Andrew's reaction, comes to believe that the event does indeed reveal a great deal, and that a serious threat exists. Carol would tend to discount the risk, but once she hears the shared opinion of Andrew and Barry, she is frightened as well. Deborah will have to have a great deal of private information to reject what has become the shared opinion of Andrew, Barry, and Carol.[77] Stylized though it is, the example shows that once several people start to take an example as probative, many people may come to be influenced by their opinion, giving rise to cascade effects. Cultural and even national differences can be explained partly in this way.

Among doctors dealing with risks and precautions, cascades are common. "Most doctors are not at the cutting edge of research; their inevitable reliance upon what colleagues have done

---

[75] See Dan M. Kahan & Donald Braman, More Statistics, Less Persuasion: A Cultural Theory of Gun-Risk Perceptions, 151 U. Pa. L. Rev. 1291 (2003).

[76] Chip Heath et al., Emotional Selection in Memes: The Case of Urban Legends, 81 Journal of Personality & Social Psychology 1028 (2001); Chip Heath, Do People Prefer to Pass Along Good or Bad News? Valence and Relevance as Predictors of Transmission Propensity, 68 Organizational Behavior & Human Decision Processes 79 (1996).

[77] See David Hirschleifer, The Blind Leading the Blind: Social Influence, Fads, and Informational Cascades, in The New Economics of Human Behavior 188, 193-4, Mariano Tommasi & Kathryn Ierulli, eds. (Cambridge: Cambridge University Press, 1995).

and are doing leads to numerous surgical fads and treatment-caused illnesses."[78] Thus an article in the New England Journal of Medicine explores "bandwagon diseases" in which doctors act like "lemmings, episodically and with a blind infectious enthusiasm pushing certain diseases and treatments primarily because everyone else is doing the same."[79] Some medical practices, including tonsillectomy, "seem to have been adopted initially based on weak information," and extreme differences in tonsillectomy frequencies (and other procedures) provide good evidence that cascades are at work.[80] Cross-cultural differences in medical practices can be explained in significant part through this route.

A distinctive feature of social cascades is that the people who participate in them are simultaneously amplifying the very social signal by which they are being influenced. By their very participation, those who join the cascade increase its size, making it more likely that others will join too. Unfortunately, cascades can lead people in mistaken directions, with a few "early movers" spurring social fear that does not match reality. In the example I have given, Andrew is having a large influence on the judgments of our little group, even though he may not, in fact, have accurate information about the relevant event. Barry, Carol, and Deborah might have some information of their own, perhaps enough to show that there is little reason for concern. But unless they have a great deal of confidence in what they do, they are likely to follow those who preceded them. The irony is that if most people are following others, then little information is provided by the fact that some or many seem to share a certain fear. Most are responding to the signals provided by others, unaware that those others are doing exactly the same thing. Of course corrections might well come eventually, but sometimes they are late.

In the domain of risks and precautions, "availability cascades" are responsible for many social beliefs.[81] A salient event, affecting people because it is available, tends to be repeated, leading to cascade effects, as the event becomes available to increasingly large numbers of people. The point is amplified by the fact that fear-inducing accounts, with high emotional valence, are especially likely to spread.[82] There is a general implication here. Because different social influences can be found in different communities, local variations are inevitable, with

---

[78] Hirshleifer, supra note, at 204.
[79] John F. Burnham, Medical Practice a la Mode: How Medical Fashions Determine Medical Care, 317 New England Journal of Medicine 1220, 1201 (1987).
[80] See Sushil Bikhchandani et al., Learning from the Behavior of Others: Conformity, Fads, and Informational Cascades, 12(3) J. Econ. Perspect. 151, 167 (1998).
[81] See Timur Kuran and Cass R. Sunstein, Availability Cascades and Risk Regulation, 51 Stan. L. Rev. 683 (1999).

different examples becoming salient in each. Hence such variations -- between say New York and Ohio, or England and the United States, or between Germany and France -- might involve coincidence or small or random factors, rather than large-scale cultural differences. Different judgments within different social groups, with different "available" examples, owe their origin to social processes of this sort. Indeed the different reactions to nuclear power in France and the United States can be explained in large part in this way. And when some groups concentrate on cases in which guns increased violence, and others on cases in which guns decreased violence, availability cascades are a large part of the reason. Return to my epigraph: "Many Germans believe that drinking water after eating cherries is deadly; they also believe that putting ice in soft drinks is unhealthy. The English, however, rather enjoy a cold drink of water after some cherries; and Americans love icy refreshments."[83]

8. Group Polarization

There is a closely related phenomenon. When like-minded people deliberate with one another, they typically end up accepting a more extreme version of the views with which they began.[84] This is the process known as group polarization. Consider a few examples:

After discussion, citizens of France become more critical of the United States and its intentions with respect to economic aid.[85]

- A group of moderately profeminist women becomes more strongly profeminist after discussion.[86]
- After discussion, whites predisposed to show racial prejudice offer more negative responses to the question whether white racism is responsible for conditions faced by African-Americans in American cities.[87]

---

[82] See Heath et al., supra note 215.
[83] See Joseph Henrich et al., Group Report: What is the Role of Culture in Bounded Rationality?, in Bounded Rationality: The Adaptive Toolbox 353-54, Gerd Gigerenzer & Reinhard Selten, eds. (Cambridge, Mass.: MIT Press, 2001), for an entertaining outline in connection with food choice decisions.
[84] See Cass R. Sunstein, Why Societies Need Dissent (Cambridge: Harvard University Press, 2003).
[85] Roger Brown, Social Psychology: The Second Edition 224 (New York: Free Press, 1985).
[86] See David G. Myers, Discussion-Induced Attitude Polarization, 28 Human Relations 699 (1975).
[87] David G. Myers & George D. Bishop, The Enhancement of Dominant Attitudes in Group Discuission, 20 J. Personality & Soc. Psych. 386 (1971),

- After discussion, whites predisposed not to show racial prejudice offer more positive responses to the same question, that is, they are more likely to find white prejudice to be the source of conditions faced by African-Americans in American cities.[88]
- Juries inclined to award punitive damages typically produce awards that are significantly higher than the awards chosen, before deliberation, by their median member.[89]

Group polarization will inevitably occur in the context of perceptions of risk; and hence group polarization helps to account for cultural and even national differences. If several people fear global warming or terrorism, and speak to one another, their fear is likely to increase as a result of internal discussions. If other people believe that nuclear power is probably safe, their belief to that effect will be fortified after they speak with one another, to the point where they will believe that nuclear power is no reason for concern. If some groups seem hysterical about certain risks, and other groups treat those risks as nonexistent, group polarization is likely to be a reason. Hence group polarization provides another explanation for the different fears of groups, localities, and even nations. Internal discussions can make Berliners fearful of risks than do not bother New Yorkers, and vice-versa; so too, the citizens of London may fear a supposed danger that does not much bother the citizens of Paris – even if the danger is not greater in the former than in the latter.

Group polarization undoubtedly occurs in connection with the availability heuristic. Suppose, for example, that several people are discussing mad cow disease, or a recent wave of sniper attacks, or cases involving the kidnapping of young girls, or situations in which the government has wrongly ignored a serious foreign threat. If the particular examples are mentioned, they are likely to prove memorable. And if the group has a predisposition to think that one or another risk is serious, social dynamics will lead the group to believe that the example is highly revealing. An initial predisposition toward fear is likely to be aggravated after collective deliberations. Within groups, a tendency toward fear breeds its own amplification.

Consider in this light the 2004 report of the United States Senate Select Committee on Intelligence, which contended the Central Intelligence Agency's predisposition to find a serious threat from Iraq led it to fail to explore alternative possibilities or to obtain and use the

[88] See id.
[89] See Cass R. Sunstein et al., Punitive Damages: How Juries Decide (Chicago: The Univ. of Chicago Press, 2002).

information that it actually held.[90] Falling victim to group polarization in the particular context of fear. the agency showed a “tendency to reject information that contradicted the presumption” that Iraq had weapons of mass destruction.[91] This claim is a remarkable echo of one that followed the 2003 investigation of failures at NASA, in which the Columbia Accident Investigation Board explicitly attributed the accident to NASA's unfortunate culture, one that does too little to elicit information. In the Board's words, NASA lacks "checks and balances"[92] and pressures people to follow a "party line."[93] The result was a process of polarization that led to a dismissal of serious risks.

9. Media, Interest Groups, and Politicians

It should be clear that in the real world, some voices are more important than others, especially when availability and salience are involved. In particular, the behavior and preoccupations of the media play a large role. Many perceived “epidemics” are in reality no such thing, but instead a product of media coverage of gripping, unrepresentative incidents. Attention to those incidents is likely to ensure availability and salience, promoting an inaccurately high estimate of probability and at the same time some degree of probability neglect. And in the face of close media attention, the demand for legal responses will be significantly affected. Changes within and even across nations are a natural result.

Knowing the importance of media coverage, well-organized private groups work extremely hard to promote public attention to particular risks. Some of these groups are are altruistic; others are entirely self-interested. The common tactic is to publicize an incident that might trigger both availability and salience. Terrorists themselves are the most extreme and vicious example, using high-visibility attacks to convince people that “they cannot be safe anywhere.” But many illustrations are less objectionable and sometimes even benign. In the United States, consider the abandoned hazardous waste at Love Canal, used to promote hazardous waste cleanup, or the Exxon Valdez disaster, used by the Sierra Club and other environmental organizations to promote more stringent safeguards against oil spills. Showing at

---

[90] Available at http://intelligence.senate.gov/.
[91] Id. at 6.
[92] Report of The Columbia Accident Investigation Board, available at http://www.nasa.gov/columbia/home/CAIB_Vol1.html, at 12.

least a working knowledge of the availability heuristic, private groups seize on selected incidents and publicize them to make them generally salient to the public. In all of these examples, the use of particular instances might be necessary to move the public, and legislatures, in the right directions. Certainly the social processes that interact with salience and availability can promote reform where it is needed. But there is no assurance here, particularly if social influences are leading people to exaggerate a problem, or to ignore the question of probability altogether.

Politicians engage in the same basic project. By its very nature, the voice of an influential politician comes with amplifiers. When public officials bring an incident before the public, a seemingly illustrative example is likely to spread far and wide. A legal enactment can itself promote availability; if the law responds to the problems associated with hazardous waste dumps, or "hate crimes," people might well come to see those problems as readily available. The terrorist attacks of September 11, 2001 would inevitably loom large no matter what President George W. Bush chose to emphasize. But the President, and his White House generally, referred to the attacks on countless occasions, frequently as a way of emphasizing the reality of seemingly distant threats and the need to incur significant costs to counteract them (including the 2003 Iraq war, itself fueled by presidential speeches including vivid narratives of catastrophic harm). And there is no doubt that the salience of these attacks played a large role in affecting political behavior – and that this role cannot be understood without reference to social influences. The implications for cultural differences should be clear. If leaders in different nations draw attention to different risks, there will be large-scale differences in risk perceptions.

10. Predispositions and Culture

But all this does not provide the full picture. Beliefs and orientations are a product of availability, and social influences ensure both availability and salience. But as I have suggested, what is available is also a product of antecedent beliefs and orientations, both individual and social. In other words, availability is endogenous to, or a product of, predispositions, individual, cultural, and national. A great deal of further work remains to be done on this topic.[94]

---

[93] Id. at 102.

[94] On culture, an influential treatment is Mary Douglas and Aaron Wildavsky, Risk and Culture (1984); a natural reading of work by, and inspired by, Douglas and Wildavsky is that availability is a product of cultural orientations, rather than vice versa. But see Vogel, supra note, for a contrasting view.

Why do some people recall and emphasize incidents in which a failure to take precautions led to serious environmental harm? A likely reason is that they are predisposed to favor environmental protection. And why do some people recall and emphasize incidents in which environmental protection led to huge costs for little gain? A likely reason is that they are predisposed to oppose environmental controls. Here is an interaction between the availability heuristic and confirmation bias—"the tendency to seek information to confirm our original hypotheses and beliefs,"[95] a tendency that reviewers have found in the judgments, referred to above, of both the Central Intelligence Agency and NASA. Confirmation bias plays a large role in different risk perceptions across individuals and groups. If members of a culturally distinct group are predisposed to believe that new technologies are risky, or that genetically modified organisms are hazardous, or that cell phones produce cancer, apparently supportive illustrations will be memorable, and contrary ones will be discounted.

Of course predispositions are not a black box, and they do not come from the sky. They have sources. Among their sources are availability and salience. After incidents of mad cow disease in England, many Europeans lost trust in the relevant authorities and acquired a predisposition to fear, and to take and urge precautions against, associated and analogous threats. In Europe, the growth of precautionary thinking, across certain domains, had a great deal to do with particular salient incidents.[96] Hence there is complex set of interactions, with heuristics helping to constitute predispositions, which are in turn responsible for the real-world operation of heuristics. All this happens socially, not merely individually; and predispositions are not static. When people are in a group that is predisposed in a particular direction, the salient examples will be quite different from those that are salient in a group with an opposite predisposition. Here group polarization is especially important. What is sometimes described as "culture," or as "deep-rooted cultural differences," may be no such thing. Cascade effects and polarization, interacting with availability, can be responsible for inclinations and variations that might well have taken another form.

On the other hand, different cultural orientations can play a large role in determining what turns out to be available. For example, the United States is highly diverse, and for some purposes, it is plausible to think of different regions and groups as having different cultures.

---

[95] See Elliott Aronson, The Social Animal 150 (New York: W.H. Freeman, 7th ed., 1995).
[96] See Vogel, supra note.

Within African-American communities, the available instances are sometimes quite different from those that can be found within all-white communities. Across nations, the differences are even more striking, in part because different world-views play such a dominant role. And what is true for individuals is true for nations as well. Just as predispositions are, in part, a function of availability, so too availability is, in part, a function of predispositions. Social influences operate at both levels, affecting what is available and also moving predispositions in one or another direction. The problem is that both individuals and societies may be fearful of nonexistent or trivial risks – and simultaneously neglect real dangers.

11. Conclusion

In this essay I have ventured a conceptual claim and a psychological hypothesis. The conceptual claim is that it is not possible to be "precautionary" in general. An individual or a nation can take precautions against particular risks, to be sure, but no individual or nation can be precautionary as a general proposition. The reason is that risks are on all sides of social situations. If a person or state purports to be precautionary, it is almost certainly taking steps that create risks of their own. The point certainly holds for aggressive regulation of genetic modification of food and greenhouse gases; it holds as well for preemptive wars.

The psychological hypothesis is that the operation of the Precautionary Principle, and differences in risk perception among nations, have a great deal to do with the availability heuristic. If people can think of cases in which a risk has come to fruition, they are far more likely to think that the risk should be taken seriously. "Availability bias," in the form of excessive fear, and "unavailability bias," in the form of unjustified neglect, are unfortunate results. All cultures suffer from both of these. But they suffer from them in different ways, because what is available in one culture is often less available, or unavailable, in others.

Of course availability is a product of social influences. Cascade effects and group polarization play substantial roles in making one or another incident available to many or most. There are multiple equilibria here: It is hardly inevitable that SARS would have great salience in Canada but not in the United States. Single incidents and small shocks can make an extraordinary difference. Moreover, what is available to some will not be available to all, in part because of social influences, and in part because of individual, cultural, and national

predispositions. Hence I have emphasized that some cultures will find some risks “available” not because of simple facts, but because the relevant citizens are predisposed to focus on some risks but not on others.

I believe that the availability heuristic provides many clues about the operation of the Precautionary Principle and cross-cultural risk perceptions. But a great deal of empirical work remains to be done, not least in exploring the complex interactions among individual cognition, cascade effects, the behavior of those who spread information, and cultural predispositions.